

**Amendment and Response**

Serial No.: 09/520,032

Confirmation No.: Unknown

Filed: 6 March 2000

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least four planar surfaces adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity said three-dimensional cavities comprise pyramidal shapes each pyramidal shape comprises planar surfaces which intersect to form a material-included angle at a distal end of said pyramid, wherein said material-included angle is a value from 25° to 90°, and wherein each of the cavities has a single opening.

20. (THRICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite,

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said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein the production tool is a roll, and wherein each of the cavities has a single opening.

21. (THRICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein

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adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

25. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

26. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

27. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

28. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

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33. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

34. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

35. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the

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first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

36. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

37. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

38. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

39. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the

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two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

40. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is a coating, and wherein each of the cavities has a single opening.

41. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

42. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

43. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

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44. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

45. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

46. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the

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first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

47. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

48. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

49. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

50. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the



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two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

51. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

52. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

53. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

54. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

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94. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

95. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

96. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

98. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

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99. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

100. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

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101. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

102. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

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103. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

104. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

105. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities the first plurality of cavities each have a

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first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

106. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

107. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the

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base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

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108. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

109. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

110. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

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111. (THRICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

133. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

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134. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

135. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

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136. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening; and forming the production tool using the design.

137. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

138. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second



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plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

139. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

140. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

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141. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

142. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

143. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

144. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production

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tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

145. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

146. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

147. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the

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angles of intersection of said second cavity, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

148. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

149. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

150. (AMENDED) A method of making a production tool, the method comprising:

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creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and forming the production tool using the design.

151. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

152. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the

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pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

153. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

154. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape the angles are different in at least two of the cavities at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

155. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

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156. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

157. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

158. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

159. (AMENDED) A methods of making a production tool, the method comprising:

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creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

160. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

161. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

162. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the



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geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

163. (AMENDED) A method of making a production tool, the method comprising:

98 creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

164. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape,

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the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

165. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

166. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

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167. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

168. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

169. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

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170. (AMENDED) A method of making a production tool, the method comprising:
- creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and
- forming the production tool using the design.

171. (AMENDED) A method of making a production tool, the method comprising:
- creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the

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first, third, and fourth plurality of base edge lengths at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

172. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

173. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and

forming the production tool using the design.

174. (AMENDED) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least 50% of pairs of adjacent cavities have at least one

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base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.

175. (AMENDED) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities the cavities each have dimensions defining the cavity, the dimensions including base edge lengths at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening; and  
forming the production tool using the design.
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